IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Giuliano CAVAGLIA	Confirmation No: 9565
Appl. No.	:	10/523,650	
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Title	:	CONTINUOUS PROCESS FOR SOLID PHASE POLYMERIZATION OF POLYESTERS	
TC/A.U.	:	1796	
Examiner	:	G. Listvoyb	
Docket No.:	:	CAVA3001/REF	
Customer No:	:	23364	

REPLY BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Sir:

This is in response to the Examiner's Answer of July 7, 2010, in connection with the above identified application. The period for filing a Reply Brief is set to expire on September 7, 2010. The present Reply is timely filed.

In addition, under separate cover, Applicant requests an Oral Hearing in connection with this Appeal.

CLARIFICATION OF STATEMENT OF REJECTION

There is an error of omission in the Statement of Rejection on page 3 of the Examiner's Answer in that claims 113 and 117 are not included in the statement of rejection but are rejected in the body of the rejection. Therefore, the rejection is understood to include claims 56, 59-63, 84-92, 95, 100-107, 109-113, 117, and 118.

SUMMARY

While each of the Examiner's responses found in the Examiner's Answer are argued independently below, the following first summarizes what one of ordinary skill knew at the time of the invention, relative to the Examiner's proposed combination.

I. SUMMARY OF STATE OF THE ART KNOWN TO ONE OF ORDINARY SKILL

Throughout the prosecution and appeal, it has been established, and unrefuted by the Examiner, that:

At the time of the invention, one of ordinary skill in the art of making polyester resins selected the reactor based upon whether the polyester was in the form of a pellet or a powder (Rinehart, col 1, lines 52-53) "the form of the prepolymer has essentially dictated the type of solid state polymerization process".)

At the time of the invention, one of ordinary skill knew that particles having at least one dimension greater than 1mm are pellets and particles less than 1mm are powders. (Applicant's unrefuted response submitted May 18, 2008 at page 15)

At the time of the invention one of ordinary skill knew the vertical reactor was the conventional reactor used throughout the industry as outlined in the instant specification at page 2, lines 8-11.

> "If we analyze all the conventional solid phase polymerization processes available today [thus, at the time of the invention, not at the time of Kerpes or Coover], it will result that the polyester prepolymer . . . is fed into the top of a vertical moving or static bed reactor for solid phase

polymerization in which it moves down by gravity in contact with a stream of pre-heated purge gas.

The vertical reactor is considered the "workhorse" of the industry. (Declaration of Dr. Doug Callander at 13; See also Duh '762 Col 3 starting at line 19 and Figures).

One of ordinary skill knew that particles larger than 0.841 mm were not used in rotating horizontal reactors because of the tendency to discolor (Coover, Col 4, Line 73 teaching that particles greater than 20 mesh (0.841 mm tend to discolor in the rotating horizontal reactor) and that horizontal reactors generate fines (Declaration of Verne Rinehart at 9 and 12, Declaration of Dr. Doug Callander at 12, and Coover, col 5, lines 30-40).

One of ordinary skill knew that discoloration destroys the utility of the resin for bottles. (Declaration of Dr. Doug Callander at 11). This statement is unrefuted by the Examiner.

One of ordinary skill knew that fines presents many problems in the use of polyester resin. (Declaration of Vern Rinehart at 9 and 12; Declaration of Dr. Doug Callander at 12).

II. SUMMARY OF THE REJECTION

The rejection can be summarized as stating that one of ordinary skill knowing the above unrefuted statements above, in practicing the process of Kerpes to make polyester resin for bottles in the form of a pellet as required by Kerpes would:

Cast aside the industry practice that the particle form (pellet or powder) “dictates” the selection of the reactor, and one of ordinary skill would not select the conventional vertical reactor but would, rather;

Select the horizontal rotating reactor of Coover based upon Coover’s comment that the horizontal reactor produced a substantially uniform I.V. in powders, ignoring that Coover itself teaches that larger particles (pellets) tend to discolor and the well established problems associated with fines.

III. DISCOLORATION AND FINES

A. DISCOLORATION

That Coover teaches that larger particles tend to discolor and that according to Dr. Callander, one of ordinary skill knows that discoloration destroys the use of the resin for bottles, the utility of Kerpes is unrefuted in the Examiner’s Answer. While accepting the premises, the Examiner’s Answer concludes, without evidence, that one of ordinary skill knows that the pellets of Kerpes would not discolor in the rotating horizontal reactor because the I.V. lift is low and because the discoloration of the pellets did not occur in Kerpes experiments.

A. DISCOLORATION AND I.V. LIFT

The Examiner's Answer does not provide the required reasoning how or why one of ordinary skill would know that a low IV lift would keep the pellets from discoloring in the rotating reactor when Coover discloses that larger particles discolor. The issue is whether one of ordinary skill knew at the time of the invention that I.V. lift would prevent discoloration, not reduce it or lessen it, but eliminate so as to overcome Coover's teaching that larger particles tend to discolor. There is no evidence in the record or theory presented by the Examiner establishing how or why one of ordinary skill would know that even though Coover teaches away from using large particles because they tend to discolor which would destory the utility of the resin for bottles, that the low IV lift would keep the pellets from discoloring. Coover also teaches that the larger size particles have a slower reaction rate, so even though the IV lift is low, the pellets remain longer in the reactor. (Coover, col 4, lines 72-73) The fact remains, Coover teaches that the discoloration is due to the larger particle size, and one of ordinary skill knows, according to Dr. Callander, that the discoloration renders the resin useless for making uncolored bottles, defeating the primary objective of Kerpes.

B. FINES AND SHEAR

The Examiner's Answer states that although one of ordinary skill knows that the rotating reactor generates fines and that fines are bad; that one of ordinary skill knows the rotation speed can be reduced enough to eliminate the shear so as to not generate fines. The Examiner's Answer provides no evidence or reasoning as to how or why one of ordinary skill would know this. The belief that the process can be run slow enough to eliminate the fines is based upon the assumptions that one of ordinary skill knows that (1) the reactor can be slowed down enough to sufficiently remove the shear and fines and (2) the remaining shear produces less fines than the vertical reactor where the pellets are dropping in a perfect plug flow manner.

1) The reactor CANNOT be slowed down to eliminate shear.

That the reactor can be slowed enough to sufficiently remove the shear and fines is not established in the Examiner's Answer and in fact, is proven invalid in the instant specification at page 10, lines 12-16.

> This flow regime, named rolling, is such that, when granules are submersed in the bed of solid, they behave as a rigid body and rotate at the same rotational speed of the horizontal reactor, and, when they come at the surface of the solid bed, they slide on the surface itself. This solid flow regime is essential in order to have a true plug flow behaviour of the solid phase.

Therefore, because one of ordinary skill knows plug flow is essential to homogeneity and uniformity of the final product (Specification at page 3, lines 5-11, Declaration of Verne Rinehart at 9) one of ordinary skill cannot reduce the

rotational speed so low as to avoid the pellets sliding against each other and forming fines. To do so would destroy the plug flow essential to the uniform I.V.

The reactor rotational speed must be kept high enough (in the rolling flow regime) so that the pellets come to the surface of the solid bed and slide on the surface itself - - that is, the pellets must slide against each other – which is avoided in the vertical reactor where the pellets drop vertically as a mass. Were one of ordinary skill to lower the reactor's rotational speed so that the pellets do not rub against each other as proposed in the Examiner's Answer, the flow would no longer be plug flow – and without plug flow, one of ordinary skill knows that the pellet IV uniformity will be compromised as the pellets will have different residence times in the reactor.

2) The rotating reactor has more shear than the vertical reactor.

That the rotating reactor has more shear than the vertical reactor is intuitive and proven in the experiments of the instant specification as well. The lack of shear in the vertical reactor caused the pellets to lump together, while the shear in the rotating reactor ". . . constantly renew[ed] the inter-granule contact areas so that the polyester granules [did] not have a chance to creep into one another" (stick together). (Specification at page 10, lines 2-5). In other words, the shear in the horizontal reactor prevented the lumping at the higher temperatures as the pellets were not in contact with each other long enough for the sticky outsides to "grow into each other". (See the results of experiments 1 and 2 comparing the rotating reactor with the vertical reactor at pages 16-18).

The individual argument in the Examiner's Answer will now be addressed

RESPONSES TO

<u>Coover does not teach one skilled in the art that the rotary reactor is used to prevent powder buildup as urged in the Examiner's Answer</u>

On page 13 of the Examiner's Answer, in the first sentence of item (10) Response to Argument, it is stated that Appellant submits that Coover uses the rotary reactor in order to prevent powder buildup in the polymerization reactor. Appellant has no idea of the basis for this interpretation. Alleging that Coover uses the rotary reactor to prevent powder buildup is a complete misunderstanding and misstatement of the word "buildup" as used by Coover. The Examiner's Answer states that Appellant is saying that Coover's reactor is used to prevent powder buildup but Appellant has made no such statement. Appellant believes that the Examiner's Answer is using the word "buildup" to mean retention which is broken by the rotary action. However, that is <u>not</u> the definition of the phrase powder or polymer buildup used by Coover and reflected in the Appeal Brief.

The phrase powder buildup or buildup, is referring to the increase or buildup of molecular weight of the polymer or the powder. This is also known as intrinsic viscosity (I.V.) lift, or increase in I.V. Proof that Coover's use of the word buildup to mean the operation of increasing the molecular weight (I.V.) can be found at Col 4, line 57, describing "The degree and rate of molecular weight **<u>buildup</u>** of the prepolymer is somewhat dependent upon the particle size..." and which is further explained that more

heat may be needed in "order to maintain the **powder buildup** conditions in the polymerizing range of temperatures" at Col 4, lines 34-35. Coover goes on to explicitly equate molecular weight increase with molecular weight buildup at Col 4, lines 62-63, where it states, "Obviously, the concentration and the particular ester interchange catalyst present in the pre-polymer will affect the rate of the **molecular weight buildup**." See col 4, lines 72-73, "Larger size particles tend to introduce discoloration and slow down the rate of **molecular weight buildup**." See Col 5, line 3 describing the polymerization process to increase the IV/molecular weight as **"powder buildup"**. See col 5, line 31 and line 41, describing the polymer buildup as a process or a phase not a noun as used by the Examiner. As can be seen by reviewing Coover, Coover is to a process for a rapid polymer buildup, in other words, the polymer buildup of molecular weight is not something to be prevented as asserted in the Examiner's Answer, but is the exact object of Coover's invention.

Kerpes Does Indirectly Disclose Pellet Size Contrary To the Indication in the Examiner's Answer

The fourth paragraph of page 13 of the Examiner's Answer, states first that Kerpes does not disclose the size of his granules and uses Duh to provide a standard pellet size, while at the same time asserting that Coover teaches the same particle size. This analysis is wrong in two ways:

First, Kerpes does disclose enough information to determine the pellet size, assuming a sphere or cylinder of Duh's aspect ratio. (Appeal Brief, Page 8, para 1). Kerpes (col 4, lines 9-13) provides the range of surface area and pellet mass to

accomplish his invention which is the limited IV lift, or polymer buildup in molecular weight. Knowing the density of crystallized polyester (specific gravity), the diameter of the sphere having the stated mass of Kerpes can easily be determined as noted in the Appeal Brief. While the Appeal Brief did not address a pellet of the aspect ratio of Duh, the same parameters can be used making the ratio of the height of the cylinder to the diameter. Assuming the 1/8 inch diameter to 3/16 inch height porous pellet of Duh, the dimensions of a pellet of that aspect ratio in the surface are of Kerpes is a diameter of 1.56 mm and a height of 1.04 mm. It should be noted that the Duh porous pellet is a pressed powder after it has been ground, and therefore all the arguments and declarations of Rinehart apply to Duh as well. These pellet sizes are far greater than the minimum of 1mm used to distinguish a pellet from a powder as established in Applicant's 18 May 2008 Response at page 15.

The second error is in the conversion from inches to millimeters apparently used to determine that 1/8th of an inch equals 0.3 mm and 3/16th of an inch equals 0.5 mm. There are 25.4 mm per inch, therefore 1/8th inch (0.125) is 3.175 mm and 3/16th of an inch is 4.76 mm; not 0.3 and 0.5 as found in the Examiner's Answer. It should be noted that this is similar to the conversion error made the 31 August 2007 office action where it was maintained that Coover taught particles of 5mm (31 August 2007 p4, par. 4). In both instances, this finding of fact is off by a factor of 10.

As noted in US Patent 5,449,701 (Duh) which describes at column 1, in the background of the invention, that high molecular weight polyesters are commonly produced from low molecular weight polyesters of the same composition by solid state polymerization. The low molecular weight polyesters which are used in such solid state

polymerizations are generally prepared by conventional melt polymerization. The molten polyester product of such melt polymerizations is convened to solid granules in the shape of pellets, chips or cubes. Solid state polymerization of such pellets, chips, or cubes is generally considered advantageous in that the handling of high molecular weight ultra-high viscosity molten polymers is eliminated.

As further stated beginning at line 26 of column 1, solid state polymerization of a polyester involves two major steps: chemical reaction and diffusion of reaction by-products, e.g. water and ethylene glycol. (Acetaldehyde is also a byproduct which needs to be removed.) Therefore, the solid state polymerization rate can be increased by reducing the diffusional resistance within the prepolymer granules. The diffusion resistance can be reduced by reducing the prepolymer particle size. However, without shear, smaller granules have higher tendencies to stick together, during solid state polymerization, causing process difficulties. Therefore, there exists a minimum particle size (pellet size) that is suitable for solid state polymerization which does not include the powders of Coover.

<u>There is no reasoned basis for the conclusion that Coover's Reactor With Pellets Produces Better Mass Transfer, Compared to the Regular One Urged in the Examiner's Answer</u>

It is also urged on page 13 of the Examiner's Answer that it is clear that Coover's design produces better mass transfer, compared to the regular one. There is no indication of what is meant by the "regular one" in the Examiner's Answer or in Coover. Moreover, this is a conclusionary statement taking Official Notice without the necessary

factual basis required by MPEP § 2144.03. In this regard, it is noted that the Coover patent application was filed in 1959, deals with the treatment of powders, specific polymers made with a specified titanium catalyst, and provides alternative reactors including an upright cylindrical blender (column 5, et seq.) As indicated at column 1, the invention relates to the use of titanium catalyst and a solid phase process for preparing polyesters in which it has been found that the solid phase polymerization can be conducted under approximately atmospheric pressure of an inert gas when the particles of a prepolymer are prepared by a process which involves a use of a titanium catalyst. The process comprises at least three steps including a first melt polymerization to form a prepolymer which is then comminuted (ground) to form solid particles (powders) substantially completely passing a twenty mesh screen with less than 25% passing a 200 mesh screen. As evidenced by Applicant in the May 18 2008 Response at page 15, one of ordinary skill in the art would clearly understand that this is a powder and not granules which are preferably used as taught by Duh in 1995 and as developed in the art over the years and as required by the claims on appeal.

This is followed by the powder build-up operation, that is, increasing the molecular weight of the powder which includes alternative polymerizing zones as described at column 4, beginning at line 18 of Coover, which states that the powder buildup operation is conducted in an enclosed polymerization zone wherein at least 5% of the volume as occupied by the particles. Such a zone can be a horizontal tube, upright cylinder or any other chamber through which inert gas can be conveniently moved across the surface of the particles.

As further stated later in the column, at line 49, according to one preferred method of practicing this invention a prepolymer is finely ground to form solid particles (i.e., powders) in the 40 to 70 mesh size which are heated in a horizontal glass or metal tube at the polymerization temperature while a stream of dry nitrogen is passed through the tube and over the bed of polyester particles until the desired increase in molecular weight of the polyester is obtained.

The patent continues to state that the degree and rate of molecular weight build-up of the prepolymer is somewhat dependent upon the particles size, the polymerization temperature, the rate of flow of the inert gas over the bed of prepolymer, the thickness of the bed of prepolymer and the diameter of the reaction tube.

At column 4, line 69, it is stated that the particle size of the prepolymer is advantageously between 30 and 70 mesh, although larger or smaller particles may be employed within the limits set forth above. Larger size particles tend to introduce discoloration and slow down the rate of molecular weight buildup. The presence of a very high proportion of particles passing 200 mesh is undesirable since such particles tend to be picked up by the moving gas and carried away.

In support of the assertion that "it is clear that Coover's design produces better mass transfer", the Examiner's Answer refers to Coover's statement that the particles have a uniform melt viscosity and narrow weight distribution. This is presumably based on the exemplification <u>using a powder and a reactor tube which has a diameter of 22 mm with a polymer bed of 2 mm</u>. This is in clear distinction to the processing of the present invention as discussed in the examples in Applicant's specification using a pilot plant in which the inner diameter of the reactor is 1 meter and the length is 13 meters

and the vertical reactors in current use. In any case, assuming Coover's statement is true, the statement refers to the resulting polymer, which is <u>a powder</u> of very high <u>surface area per unit mass</u> relative to that of Kerpes. A spherical shape of 0.841 mm (20 mesh) diameter yields a surface area per mass of 5.4 m2/kg as contrasted to Kerpes maximum allowable surface area per unit mass of 2.9 m2/kg or almost 100% more surface area per unit mass is required for the powder buildup of Coover. Due to the vast differences in surface area per unit mass, one of ordinary skill would not infer that the result achieved <u>on powders</u> is the same as those achieved on pellets. (Note: the simplifying assumption of the sphere provides the minimum surface area for Coover. Coover's powders are ground with irregular shapes and would thus have much higher surface area than a theoretical sphere.) Additionally, as a diffusion process, the larger pellet will, by definition, have a larger I.V. gradient from skin to core as noted in Callander's Declaration. The powder's superiority is intuitively due to the short distance from the center to the skin of the powder and there is no suggestion that the horizontal reactor is superior to the other reactors described by Coover. Clearly, there is no motivation to one of ordinary skill in the art to use this reactor design with Kerpes process as urged in the Examiner's Answer. It is in fact contrary to the teachings of the art, as understood by one of ordinary skill in the art, based on the teachings of the art of record and declaratory evidence of record.

<u>Kerpes Requires Slight IV Lift For Acetaldehyde Removal</u>

On page 15 of the Examiner's Answer it is stated that however, the purpose of Kerpes process is only a slight IV lift. This is confirmed throughout the patent and

especially at column 3, line 43, wherein it is indicated that the intrinsic viscosity (IV) of the final polyester for food packaging is composed of the intrinsic viscosity which is achieved in the melt phase and the increase (lift) of the intrinsic viscosity which occurs during the solid phase treatment which immediately follows. The solid phase treatment is directed to obtaining the low acetaldehyde values which are desired. The increase of the intrinsic viscosity should correspond only to that which accompanies this dealdehydization. The intrinsic viscosity which is obtained in the melt phase should thus lie slightly lower than the desired end viscosity, for example by 0.05 to 0.15 dl/g, preferably by 0.07 to 0.12 dl/g, lower than this end viscosity. This is in clear distinction to the claimed process and in particular, claim 106, wherein the intrinsic viscosity of the polyester is increased at least 0.35 dl/g during the solid state polymerization aspect of the claimed process. The teachings of the Kerpes reference clearly leads one away from that of the presently claimed invention wherein the solid state polymerization is used to substantially increase the intrinsic viscosity. Moreover, as stated on page 14 of the Examiner's Answer, the Examiner uses Coover for the purposes of the reactor modification. That is, reactor modification and not for modification of the Kerpes processing requirements and steps which is part of the invention as a whole.

Despite this statement, at page 16 of the Examiner's Answer, it is stated that, "However, Coover teaches horizontal rotating tilted reactor, where IV lift of at least 0.4 dl/g is achieved." Clearly, this simply represents picking and choosing and combining those portions of the prior art which are relevant to the claimed subject matter from the prior art based upon the claimed invention on appeal and Applicant's disclosure and totally ignores the clear teaching of the prior art which leads away from this combination

of references and the obviousness of the claims on appeal. Even under KSR, such a combination is impermissible. It is similar to distilling an invention down to the "gist" or "thrust" of an invention which disregards the requirements of analyzing the subject matter as a whole. See § MPEP 2141.02 II distilling the invention down to a gist or a thrust of an invention disregards as a whole requirement and cases cited therein where in treating the advantages the invention disregards statutory requirement that the invention be viewed as a whole. One of ordinary skill in the art would know the difference between processing powders and granules in the art which dictate the equipment used and would not ignore the limitations required by the processing aspects and reactors as utilized in the process. Clearly, one of ordinary skill in the art would not combine the references as suggested in the final rejection and this rejection should be withdrawn or reversed on Appeal.

<u>The appellant submits that the criteria set forth in the MPEP provides guidance in determining the issue of obviousness of the claims on appeal</u>

---SECTION---2143 Examples Of Basic Requirements of a Prima Facie Case of Obviousness

The Supreme Court in KSR International Co. v. Teleflex Inc., 82 USPQ2d 1385, 1395-97 (2007) identified a number of rationales to support a conclusion of obviousness which are consistent with the proper "functional approach" to the determination of obviousness as laid down in Graham. The key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would

have been obvious. The Supreme Court in KSR noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. (Emphasis added.)

> SECTION---2143.03 All Claim Limitations Must Be Taught or Suggested
> To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Appellant also most respectfully directs the Examiner's attention to MPEP § 2144.08 (page 2100-130) wherein it is stated that Office personnel should consider all rebuttal argument and evidence present by applicant and the citation of In re Soni for error in not considering evidence presented in the specification.

A statement that modifications of the prior art to meet the claimed invention would have been "'well within the ordinary skill of the art at the time the claimed invention was made'" because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). **"'>[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to

support the legal conclusion of obviousness.'" *KSR*, 550 U.S. at ___, 82 USPQ2d at 1396 quoting *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006).<

<u>There is no basis for taking Official Notice that the angle of slant of the reactor in the claimed process is within measurement of error</u>

It is noted that with respect to claim 112, which requires a rotation speed and a degree of slope of 0.1 to 12 degrees, is not suggested in the prior art and that a slope of 0.1 degree practically means horizontal reactor, since this angle is within the measurement of error. This statement is specifically traversed as there is nothing to support this conclusion. This is a conclusionary statement taking Official Notice without the necessary factual basis required by MPEP § 2144.03. Laser levels are conventionally used in this field and there is no indication that a laser level would not meet the requirement of 0.1 degree from the horizon. This is especially true in view of the length of the reactor used in the process. Moreover, there is nothing to suggest that the claim rotational speed is normally used in commercial reactors.

<u>The Examiner's Answer ignores the factual declarations of Rinehart and Callander, as required by decision cited in the Appeal Brief of, In re Rinehart</u>

The Examiner's Answer ignores the factual declarations of Rinehart and Callander at page 14 which is required by In re Rinehart. Rather than do the required resolution of Rinehart's technical statement and explanation of the operation of the horizontal reactor, the Examiner's Answer dismisses Rinehart's declaration as not

relevant because it is in the context of "comparing Rinehart (4876326) with the reactor of Coover and Barkey (3497477)."

The Examiner's Answer erroneously omits the patent number of Coover (3,075,952). As such the impression is created that Coover and Barkey (3497477) are one reference addressed by Rinehart. This is not true. Rinehart's declaration discusses both Coover (3,074,952) AND Barkey (3,497,477) (See Rinehart, at 6). While Rinehart and Barkey may not be cited in the final rejection, Rinehart's statements as to Coover (3,074,952) as to the inefficiency of the horizontal reactor and what one of ordinary skill knows about the horizontal reactor are still valid and need to be addressed and resolved in the Examiner's Answer, not dismissed. The fact that Rinehart's knowledge is corroborated by Dr. Callander as explained in the Appeal Brief (p9) needs resolved in the Examiner's Answer. When one of extraordinary skill in the art such as Dr. Callander knows of no evidence to support the statement in the rejection and the Examiner's Answer of more effectiveness and believes the opposite to be true, the Examiner must present some evidence supporting the contrary position.

The Examiner proceeds to restate the advantages from Coover, but as pointed out earlier, these advantages are achieved when the polymer is converted to a powder requiring a surface area to mass ratio way beyond the limits of Kerpes.

The Examiner's Answer has two positions to Dr. Callander's position, an expert in solid phase processing of polyesters, that one of ordinary skill knows that putting the large granules into the reactor of Coover would create discolored granules and thus render the pellet useless for the bottles of Kerpes. The first position is that Kerpes is

only a slight I.V. lift of 0.05 to 0.15. It is unclear how this maintains the utility, as Coover produces an I.V. lift of at least 0.4. The second position, that Kerpes' granules are colorless (discolored) is irrelevant. The color is generated by using the granules in the reactor of Coover, something which is not contemplated by Kerpes.

Coover tells one of ordinary skill in the art that the pellets will tend to discolor when using particles greater than .841 mm (20 mesh) in the horizontal reactor. This is not Dr. Callander's teaching, but Coover's teaching to one of ordinary skill. That a larger particle, which has less surface area per mass will take longer to diffuse and react is intuitive. Coover teaches that the longer the larger polyester particles are exposed to the temperature the more color is generated. That discoloration renders the resin useless for bottles and destroys the primary utility of Kerpes resin is unrefuted. Therefore, the Examiner's Answer fails to address Dr. Callander's conclusion that the threat of discoloration is enough to prevent one of ordinary skill from combining the references as set forth in the rejection.

<u>In Duh's process the particles with high molecular weight ultra-high viscosity are not formed in the melt and because of that the handling of high molecular weight ultra high viscosity molten polymers is eliminated.</u>

On page 17 of the Examiner's Answer, it is stated that, "Examiner disagrees. In Duh's process the particles with weight ultra-high viscosity are not formed and because of that the handling of high molecular weight ultrahigh viscosity molten polymers is eliminated." It is eliminated because the polymerization to the higher molecular weight takes place in the solid phase and not in the melt. It is not because of the form of the

particles as suggested in the Examiner's Answer. The portion of Duh's patent referred to in the final rejection concerns the background of the invention which relates to the formation of PET polymers and in fact refers to one of Declarant Rinehart's patents at column 1, line 48.

Processes for PET formation are also discussed in a further Duh patent 6,403,762 which is of record in this appeal. This patent relates to a process for the production of the polyester poly(trimethylene terephthalate) (PTT) and more particularly relates to the invention to an improved method of preparing the melt polymerization prepolymer for solid state polymerization.

As noted at the beginning of line 45 of column 1 of Duh's '762 patent, the continuous solid state polymerization (SSP) process for the production of polyethylene terephthalate (PET) after melt polymerization is essentially the same process which is currently used commercially for PTT. This process is described wherein prepolymer granules or pellets are first crystalized in a crystallization unit. Then, the crystallization pellets are dried and annealed in a dryer/annealer apparatus. The dried and annealed pellets are then preheated to the reaction temperature for SSP in the preheater apparatus as shown in the Figures of the Duh '762 patent, reference numeral 3.

This process is described at column 3, beginning at line 19 of the patent which states the crystallized and preheated pellets are discharged from the crystallizer/pelletizer into the reactor 3. Inside the reactor, solid states polycondensation takes place as the polymer pellets move downward by gravitational force in contact with a stream of inert gas, usually nitrogen which flows upwardly to sweep away the reaction bi products. This is further evidence of the state of the art as of the date of the Duh

patent, filed June 26, 2001 that vertical reactors represent the state of the art as would be understood by one of ordinary skill in the art to which the invention pertains.

As stated at column 3 of Duh, beginning at line 3, surprisingly, I have discovered, in contrast to the behavior of PET in the SSP process, PTT prepolymer pellets can be directly exposed to the preheating or reaction temperature without significant polymer sticking and depolymerization problems. This makes it possible to drastically simplify the prereaction steps for the SSP of PTT. The present invention describes such a simplified SSP process.

As noted at the bottom of column 4 of this patent, solid state polymerization proceeds in order to further polymerize the polymer to increase the intrinsic viscosity to the desired level, usually in the range of 0.80 to 0.94 dl/g, which is required for fiber applications.

Coover does not contradict Appellant's position that in a rotating horizontal reactor, shear force will be exerted on any relatively large granules in the shape of pellets, chips, cubes or spheres place therein and cause the creation of undesirable fines.

In the paragraph bridging pages 17 and 18 of the Examiner's Answer, the Examiner disagrees stating that Coover does not teach any change of the particles size in his reactor during the process. In the contrary, he discloses uniform molecular weight and MWD which is only possible if the heat and mass exchange is uniform for all particles (i.e.no fines observed).

One of ordinary skill in the art would understand from Coover that Coover starts with fines, that is powder particles, as stated at column 5, line 51 of Coover, a static bed can be employed when the depth of the polymer is less than 5 mm and preferably no more than about 3 mm. As stated in example 1A of Coover the prepolymer is ground again to a particle size of 40-70 mesh which is then, in example 1B was placed in a glass tube having a diameter of 22 mm. The bed of polymer was 2 mm thick and was supported by aluminum foil. There is nothing in Coover which contradicts the evidentiary support that one of ordinary skill in the art would not use granules because of fine production. Coover is already using fines in the process and not granules. At column 5, line 30 of Coover, the temperature at which the polymerization during the powder build up is conducted should not be so high as to cause non-frangible agglomeration of the particles during the solid phase polymerization. The maximum temperature which can be employed with be determined by the precise conditions employed. By the avoidance of non-frangible agglomeration it is meant that the materials should not be fused together completely but should remain in a form such that it is quite frangible and can readily be broken up after the polymerization has been completed.

As explained in the summary section to this reply brief, the Examiner's Answer states that although one of ordinary skill knows that the rotating reactor generates fines and that fines are bad; that one of ordinary skill knows the rotation speed can be reduced enough to eliminate the shear so as to not generate fines. The Examiner's Answer provides no evidence or reasoning as to how or why one of ordinary skill would know this. The belief that the process can be run slow enough to eliminate the fines is

based upon the assumptions that (1) the reactor can be slowed down enough to sufficiently remove the shear and fines and (2) the remaining shear produces less fines than the vertical reactor where the pellets are dropping perfect plug flow manner.

1) The reactor CANNOT be slowed down to eliminate shear.

That the reactor can be slowed enough to sufficiently remove the shear and fines is not established in the Examiner's Answer and in fact, is proven invalid in the instant specification at page 10, lines 12-16.

> This flow regime, named rolling, is such that, when granules are submersed in the bed of solid, they behave as a rigid body and rotate at the same rotational speed of the horizontal reactor, and, when they come at the surface of the solid bed, they slide on the surface itself. This solid flow regime is essential in order to have a true plug flow behaviour of the solid phase.

Therefore, because one of ordinary skill knows plug flow is essential to homogeneity and uniformity of the final product (Specification at page 3, lines 5-11, Declaration of Verne Rinehart at 9) one of ordinary skill cannot reduce the rotational speed so low as to avoid the pellets sliding against each other and forming fines. To do so would destroy the plug flow essential to the uniform I.V.

The reactor rotational speed must be kept high enough (in the rolling flow regime) so that the pellets come to the surface of the solid bed and slide on the surface itself - - that is the pellets must slide against each other – which is avoided in the vertical reactor where the pellets drop vertically as a mass. Were

one of ordinary skill to lower the reactor's rotational speed so that the pellets do not rub against each other as proposed in the Examiner's answer, the flow would no longer be plug flow – and without plug flow, one of ordinary skill knows that the pellet IV uniformity will be compromised as the pellets will have different residence times in the reactor.

2) The rotating reactor has more shear than the vertical reactor.

That the rotating reactor has more shear than the vertical reactor is intuitive and proven in the experiments of the instant specification as well. The lack of shear in the vertical reactor caused the pellets to lump together, while the shear in the rotating reactor ". . . constantly renew[ed] the inter-granule contact areas so that the polyester granules [did] not have a chance to creep into one another" (stick together). (Specification at page 10, lines 2-5). In other words, the shear in the horizontal reactor prevented the lumping at the higher temperatures as the pellets were not in contact with each other long enough for the sticky outsides to "grow into each other". (See the results of experiments 1 and 2 comparing the rotating reactor with the vertical reactor at pages 16-18).

<u>Coover starts with fines and is concerned with the problem of agglomeration and not the production of fines</u>.

At page 18 of the Examiner's Answer it is stated that it is not clear, why fines form in the pellets and not formed in Coover's particles. The reason for this is self evident, since Coover's process utilizes fines, that is fine powders, and the concern is

not with the production of fines, but the agglomeration of the particles during the solid phase polymerization and temperature is controlled to avoid this. As is fully appreciated by one of ordinary skill in the art, and as established by the evidence and arguments of record, one would not use rotary reactors with pellets but instead use vertical reactors as described in the declaration evidence and references of record. Further, there is no basis or fact, to substantiate the statement on page 18 that for instance, at 0.1 rpm, the shear rate is minuscule. One of ordinary skill in the art would fully appreciate that the shear rate is dependent upon the gravitational drop which the particle is subject to.

In view of the above further reasoned arguments and those presented in the Appeal Brief and evidence of record, the appealed rejections should be withdrawn or reversed on appeal and the application issued as a patent.

Respectfully submitted,

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